

**REMARKS**

Claims 1-24 are pending. Claims 1, 4, 5, 6, 9, 10 and 21-24 are amended herein. Support for the amendments is at least found detailed below.

**Applicants' Response to the Claim Rejections under 35 U.S.C. §102/103**

**Claims 1-3, 6-8 and 21-24 are rejected under 35 U.S.C. §102(b) as being anticipated by, or in the alternative, under 35 U.S.C. §103(a) as obvious over U.S. Patent No. 6,433,359 to Kelley et al.**

In response thereto, applicants respectfully submit that Kelly does not teach each and every feature of the invention as now claimed, nor is there any reason whereby a skilled artisan would derive the present invention based on the teachings of the reference and the available skill in the art.

Specifically, there is no manner for a skilled artisan to derive at least the features of the buffer layer consisting essentially of either pentacene or pentacene fluoride, or the organic thin film is either C<sub>n</sub> fullerene (where n is an integer of 60 or more) or rubrene.

The Current Office Action has maintained the prior rejection based on Kelly by asserting that the self-assembled monolayer 16 thereof is either inherently a pentacene or it would have been obvious for the skilled artisan too utilize pentacene as the monolayer. In support of this position the new rejection cites to col. 5, line 28 to col. 6, line 6 of the reference, apparently on the basis that this section states that a pentacene or derivative thereof is utilized as the monolayer. However, Kelly does not teach or provide any reason for a skilled artisan to use pentacene itself

as the self-assembled monolayer (SAM). Rather, Kelly teaches specific aliphatic compounds must also be used.

Pentacene itself is a polycyclic aromatic hydrocarbon consisting of 5 fused benzene rings. As set forth in cols 5 and 6 of Kelly, the materials used to form the SAM have functional groups effective for bonding to the underlying gate dielectric and other groups that may form crosslinks after formation of the monolayer (5:43-46). Further, Kelly describes that the monolayer precursor is a composition having the formula:  $X-Y-Z_n$ , wherein X is H or methyl group; Y is an aliphatic containing group, and Z is a functional group (5:47-65). Of the three components, Y is the only sizable organic compound. In defining Y, Kelly specifically states:

Y is a linear or branched  $C_5$ - $C_{50}$  aliphatic or cyclic aliphatic connecting group, or a linear or branched  $C_8$ - $C_{50}$  group comprising an aromatic group and a  $C_3$ - $C_{44}$  aliphatic or cyclic aliphatic connecting group;

The rejection apparently maintains that “a linear or branched  $C_8$ - $C_{50}$  group comprising an aromatic group” may be pentacene. However, such an aromatic group must also contain the  $C_3$ - $C_{44}$  aliphatic or cyclic aliphatic connecting group. Kelly also teaches that the preferred embodiments of Y are aliphatic groups (6:5-9). Hence, there is clearly a requirement for components other than pentacene by Kelly which materially affect the properties of the SAM layer (i.e. bonding to the gate dielectric and crosslinking).

Contrary to the teachings of Kelly, the present invention as described in the Examples at pages 13-15, the precursor material of the buffer layer consist of pentacene or pentacene fluoride. There is no need for extended linear or branched aliphatic groups as required for the Y element of Kelly, nor is there a need for the functional groups of the Z element of Kelly to form the SAM.

Under U.S. patent law, the use of the transitional phrase “consisting essentially of” limits the claim to only the stated compounds and those which do not materially affect the basic characteristics and novelty of the claimed invention.

In the current instance, the large aliphatic groups and Z element functional groups required for the precursor to the self assembled monolayer of Kelly affect the characteristics and novelty of a buffer layer. Namely, in the current invention, as described in paragraph [0027] the distorted  $\pi$ -electrons of the pentacene or pentacene fluoride are necessary to achieve the two dimensional growth of the overlying organic thin film. The presence of substantial aliphatic compounds and functional groups such as those in Kelly interfere with the alignment reaction between the pentacene and the overlying organic thin film. Hence, the self-assembled monolayer of Kelly requires a number of elements which are not within the buffer layer according to applicant's invention.

**Claims 21-24 are rejected under 35 U.S.C. §103(a) as being unpatentable over *Kelley et al.* as applied to claims 1 and 6, and further in view of *Afzali-Ardakani et al.***

Applicants' respectfully note that the prior response to this rejection is not addressed within the current Office Action. Nonetheless, as previously detailed and in part detailed above, there is no basis whereby a skilled artisan would replace the in depth precursor self-assembled monolayer of Kelly with the pentacene precursor of Afzali-Ardakani. Such replacement would clearly result in the self-assembled monolayer of Kelly not properly bonding to the gate dielectric

or cross-linking. Hence, for the reasons detailed above, likewise claims 21-24 are not obvious even in further view of Afzali-Ardakani.

**Claims 21-24 are rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Publication No. 2004/0161873 to *Dimitrakopoulos et al.* in view of U.S. Publication No. 2003/0160235 to *Hirai*.**

Applicants' respectfully note that the prior response to this rejection is not addressed within the current Office Action. Nonetheless, as detailed in the last amendment, the monolayer 18 of Dimitrakopoulos contains a number of elements which are necessary for the layer to function. A skilled artisan would not replace these compositions with a buffer material consisting essentially of pentacene or pentacene fluoride, as doing so would clearly destroy the intended function of Dimitrakopoulos's monolayer. Hence, for the reasons detailed above, likewise the present invention is not obvious based on the disclosures of Dimitrakopoulos and Hirai.

Further, in response to all of the above rejections, there is no reason whereby a skilled artisan could possibly derive the use of pentacene or pentacene fluoride as a buffer layer based on the teachings of the combination of references.

According to the present invention, two dimensional growth is possible by insertion of a buffer layer for an organic thin film in which two dimensional growth was heretofore difficult.

As the result, the field effect transistors were realized as that which use the organic thin films as described in Examples 3 and 5, Figs. 5 and 15. In the Comparative Example, the fabrication of field effect transistor was impossible because there could be no two dimensional growth layer. The above-mentioned outstanding effects are neither disclosed nor implied in any of the references.

For the organic thin film deposited on the substrate via the buffer layer, several evaluations were performed for AFM, X-ray diffraction, RHEED, and the transistor properties, and actual good results were obtained. Applicants note that X-ray diffraction is the measurement method most frequently used for the evaluation of crystal quality. A good crystal was obtained according to the X-ray evaluation of the substrate of the structure as set forth in the present invention. For example, see Example 2 and Fig. 7 of the Specification. As shown in Fig. 7, the sharp peaks were observed by X-ray diffraction owing to high crystal quality of growing organic thin film. Compared with other measurement methods, the sharp peaks are observed only when an organic thin film has a high orientation over a wide area. On the other hand, a good crystal was not obtained according to X-ray evaluation of a Comparative Example in which a buffer layer was not used. See Comparative Example and Fig. 10.

In the present invention an organic thin film ( $C_n$  fullerene or rubrene) of good crystal quality may be obtained when pentacene or pentacene fluoride are used as a buffer layer because possibly  $\pi$ -electrons of the pentacene thin film 3 are distorted. See paragraphs [0026] and [0027]. In the material in which  $\pi$ -electrons remain on the outermost surface like pentacene and the material in which  $\pi$ -electrons do not remain on the outermost surface after a buffer layer is

deposited, the influence clearly differs on the orientation of the organic thin film as a second layer.

Such technical theories are not disclosed by any of the cited references. None of the references disclose any experimental data of X-ray diffraction showing organic thin film orientation which could possibly provide a reason for modification. For example, whether the organic material as the buffer layer described in any of the references is effective or not for the two dimensional growth depends upon the organic material, and it cannot be evaluated without actual crystal growth. Hence, none of the references provides a reason for a skilled artisan to derive that pentacene or pentacene fluoride are effective as the buffer layer to grow two dimensionally an organic thin film of C<sub>n</sub> fullerene or rubrene.

Wherefore, applicants respectfully submit that there is no reason whereby a skilled artisan could possibly derive the present invention based on the disclosures of the cited references. As such the present invention as set forth in parent claims 1, 6 and 21-24 is not obvious under 35 U.S.C. §103.

**Claims 3-5 and 8-10 are rejected under 35 U.S.C. §103(a) as being unpatentable over *Kelley et al.* as applied to claims 1 and 6, and further in view of U.S. Publication No. 2004/0183070 to *Afzali-Ardakani et al.***

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By addressing the rejection of the parent claims 1 and 6 based on Kelly as detailed above, likewise the rejection of these claims should be considered addressed by nature of their dependency.

In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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